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APPLICATION NO	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO	CONFIRMATION NO
09 761,240	01 17 2001	Josef-Georg Bauer	GR 98 P 2124 P	5138

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EXAMINER

MONDT, JOHANNES P

ART UNIT	PAPER NUMBER
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2826

DATE MAILED: 01 31 2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/761,240

Applicant(s)

BAUER ET AL.

Examiner

Johannes P Mondt

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED. (35 U.S.C. § 133)
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 December 2001.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☒ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

Applicants' Amendment filed 12/27/01 has been entered as Paper No. 7. A detailed response to Applicants' arguments is included in this Action (see below under "Response to Arguments"). Claims 1-3 as amended are pending at the time of this Action.

Priority

1. Applicants are reminded that, although in the previous Office Action (Paper No. 5) acknowledgment was made of applicant's claim for foreign priority based on an application filed in Germany on 07/17/98 it also pointed out that no certified copies of the priority papers have been received. It had been noted, in particular, that applicant has not filed a certified copy of the German application as required by 35 U.S.C. 119(b).

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. **Claims 1-3** are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5528058 to Pike, Jr. Et al in view of U.S. Patent No. 5357130 to Scholz et al and U.S. Patent No. 4881979 to Lewis.

Pike Jr. et al show (front page figure) a silicon based device with an emitter, a N^+ stop zone in front of the emitter, while the N^+ stop zone or barrier layer has been doped with phosphorus (e.g, page 18, line 51), a foreign atom in the silicon substrate. Hence, Pike Jr. et al is an example of the prior art mentioned, albeit not listed, in the present invention (page 6). Phosphorus has an ionization energy of about 45 meV, i.e., well within the band gap of the semiconductor (1.1 eV); however, for the purpose of this invention, i.e., to provide a stop zone active only during the OFF state, the ionization energy is small, falling short of the final limitation in claim 1 (> 200 meV away not only from the conduction band, but also from the valence band). Therefore, Pike Jr. et al only is prior art of the type mentioned, albeit not referred to, by the inventors. However, Scholz teaches the use of tellurium as a n-type dopant because its ionization energy of about 140 meV is higher than that of "conventional dopants" such as "arsenic, phosphorus" in order to avoid high levels of deionization. Therefore, the use of dopants with a high ionization energy relative to conventional dopants to enable full ionization was known at the time of the invention. In addition, the values of the ionization energies of sulfur and selenium were also known at the time of the invention, while both selenium and sulfur have long been recognized as suitable dopants in semiconductors, as exemplified by Lewis (page 14, line 21). Therefore, it would have been obvious to one of ordinary skills in the art at the time the invention was made to modify the device so as

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to include the use of either sulfur (claim 2) or selenium (claim 3) as foreign atoms in the stop zone, each VI-group element having ionization energies more than 200 meV apart from both conduction and valence bands in silicon (claim 1).

Response to Arguments

2. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the question is whether there would have been any obvious reason to combine Pike, Jr. et al as cited, or any reference equivalent to it as prior art as admitted by Applicants but not referred to, such as Bauer et al (5,710,445) (not cited in any claim rejection in this or the first Action nor presented as Information Disclosure by Applicant), with Scholz et al. and Lewis. The motivation as indicated in the first Office Action stems from the reduction in deionization (i.e., recombination) noise achieved by the use of dopants with a relatively high ionization potential. Particularly, said noise is shifted to higher temperatures in the device of Scholz (cf. column 2, lines 29-34) when a dopant with higher ionization energy in the silicon substrate is used. Parenthetically, the examiner takes official notice that it is obvious that for higher temperatures than the range $T < 40K$ contemplated by Scholz

an even higher ionization potential than that taught by Scholz et al, namely higher than that of *inter alia* tellurium, would be preferable. A simple table of ionization potentials of dopants in silicon would thus lead the way to selenium and sulfur as excellent dopants to be used in the Prior Art device of Pike, Jr., et al *casu quo* Bauer et al. for the purpose of achieving a thyristor or IGBT device that is not only suitable as a power semiconductor device but also is characterized by low noise, which is a stated purpose in Scholz et al (cf. abstract, line 2). That this is not Applicants' motivation is not relevant for the determination of patentability. Finally: the literature (both patent and journal) contains ample evidence of the desirability of combining the characteristics of high power with low noise.

Conclusion

3. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a) Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P Mondt whose telephone number is 703-306-0531. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J Flynn can be reached on 703-308-6601. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

JPM
January 28, 2002

A handwritten signature in black ink, appearing to be 'JPM', located below the typed name and date.